2015 IEEE Aerospace Conference
Abstract

Technology Development of Automated Rendezvous and Docking/Capture Sensors and Docking Mechanism for the Asteroid Redirect Crewed Mission

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This paper will describe the technology development efforts NASA has underway for Automated Rendezvous and Docking/Capture (AR&D/C) sensors and a docking mechanism and the challenges involved. The paper will additionally address how these technologies will be extended to other missions requiring AR&D/C whether robotic or manned. NASA needs AR&D/C sensors for both the robotic and crewed segments of the Asteroid Redirect Mission (ARM). NASA recently conducted a commonality assessment of the concept of operations for the robotic Asteroid Redirect Vehicle (ARV) and the crewed mission segment using the Orion crew vehicle. The commonality assessment also considered several future exploration and science missions requiring an AR&D/C capability. Missions considered were asteroid sample return, satellite servicing, and planetary entry, descent, and landing. This assessment determined that a common sensor suite consisting of one or more visible wavelength cameras, a three-dimensional LIDAR along with long-wavelength infrared cameras for robustness and situational awareness could be used on each mission to eliminate the cost of multiple sensor developments and qualifications. By choosing sensor parameters at build time instead of at design time and, without having to requalify flight hardware, a specific mission can design overlapping bearing, range, relative attitude, and position measurement availability to suit their mission requirements with minimal nonrecurring engineering costs. The resulting common sensor specification provides the union of all performance requirements for each mission and represents an improvement over the current systems used for AR&D/C today. These sensor specifications are tightly coupled to the docking system capabilities and requirements for final docking conditions. The paper will describe NASA's efforts to develop a standard docking system for use across NASA human spaceflight missions to multiple destinations. It will describe the current design status and the considerations and technologies involved in developing this docking mechanism.